Orbit of Binary Star near μ^2 Boötis. By Mr. Hind.

"I have lately calculated another orbit for the star near μ^2 *Boötis*, my object being to ascertain what alterations would be required to represent Mr. Dawes' measures of 1846, published in the *Monthly Notices* of the Astronomical Society. The new elements are as follow:—

Perihelion Passage	1852·504	$\tan. \overline{45^\circ + \frac{1}{2}\,\phi} = 0{\cdot}53041$
Position of Perihelion	226° 25′	Log. $e_{\prime} = 3{\cdot}46058$
Node	117 21	Cos. $i = 9{\cdot}83420$
Angle between ϖ and ☊ ...	103 17	
Inclination............	46 57	
Excentricity	0·84006 = sin. 57° 8′·7	
Mean Annual Motion	−33′·245	
Semi-major Axis ..	3″·218	
Period	649$^{\text{yrs}}$·72	

Ephemeris from these Elements.

	°	″
1847·00............	282·50	0·618
1847·50............	279·52	0·591
1848·00............	276·35	0·563
1848·50............	272·84	0·532
1849·00............	268·84	0·501

"I have no observations since 1846·80 (Mr. Dawes' epoch), and therefore cannot check the orbit. This appears to be an important period; if I am not mistaken, differences in the observed angle, by no means improbable, would suffice to *shorten* the period very considerably."

On an easy Method of approximating to the distance of a Planet from the Sun by means of two Observations only, made near the Planet's opposition. By Professor Chevallier.

If v be the linear velocity of the earth, and r the distance of the planet from the sun, the earth's distance being 1, the linear velocity of the planet $= \frac{v}{\sqrt{r}}$.

Also the angular retrograde velocity of the planet at or near opposition $= \frac{1}{r-1}\left(v - \frac{v}{\sqrt{r}}\right) = \frac{v}{\sqrt{r}\,(\sqrt{r}+1)}$

Again, let L, L′, be the heliocentric longitudes of the earth at the times of observation, and l, l' the *geocentric* longitudes of the planet, and let $n = \frac{L'-L}{l-l'} = \frac{\text{Heliocentric Velocity of the Earth}}{\text{Geocentric Velocity of the Planet}}$,

since the heliocentric velocity of the earth $= v$,

we have $n = \sqrt{r}\,(\sqrt{r}+1)$ and $r = \frac{1}{2}\,(1 + 2n - \sqrt{1+4n})$.

Using this formula, Mr. Chevallier deduces from the Durham observations, May 6, and 10, a mean radius vector which agrees very nearly with that computed by Mr. Graham.

On a Formula for reducing Observations in Azimuth of Circumpolar Stars near Elongation, to the Azimuth at the greatest Elongation. By Captain Shortrede.

In trigonometrical surveys the direction of a chain of triangles is often deduced from the observed azimuth of a circumpolar star at its greatest elongation. The method is convenient, as an accurate knowledge of the time is not requisite, and the latitude is generally sufficiently well known. It is indeed necessary to have the polar distance of the star with the utmost precision. In the northern hemisphere, *Polaris* and δ *Ursæ Minoris* are usually employed.

When the time is known with tolerable certainty, it is much more satisfactory to observe the star frequently, both before and after its greatest elongation, and Captain Shortrede in this memoir gives a demonstration of the formula which he has found most convenient for reducing such a series of observations of azimuth to the azimuth at the greatest elongation.

He deduces an *exact* expression for the tangent of the difference of each azimuth from the greatest azimuth, in which the only variable quantities are, the time from the greatest elongation, and the arc joining the position of the star at its greatest elongation with its position at the time of observation. The formula is easy of computation, and, when many observations have been made, would greatly facilitate their reduction.

Captain Shortrede shews, that in most cases an approximate computation of the principal variable, viz. of the secant of the arc above-mentioned, would be sufficient, and that this may be very readily effected by a formula involving $\log \frac{\text{ver. sin}}{\sin 1''}$: a table of this function for all arcs up to 1^h is added to the memoir.

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*On a Regulated Time-ball.** By Professor Chevallier.

"The usual method of indicating the time by a ball is by permitting the ball to fall freely, the motion being a little accelerated at first by a spring. It is evident that this method is subject to some uncertainty as to the particular instant of time which is to be observed. There is also some inconvenience arising from the derangement to which the apparatus is liable by the sudden stoppage of the motion of the ponderous ball.

"It is proposed to remedy these disadvantages by regulating the descent of the ball, so that its motion may be uniform, and causing it to pass through three or five horizontal hoops. The motion may be so regulated that the ball may pass through the distance between

* See p. 16 of the present volume.